Fisheries and Oceans Canada | Pêches et Océans Canada
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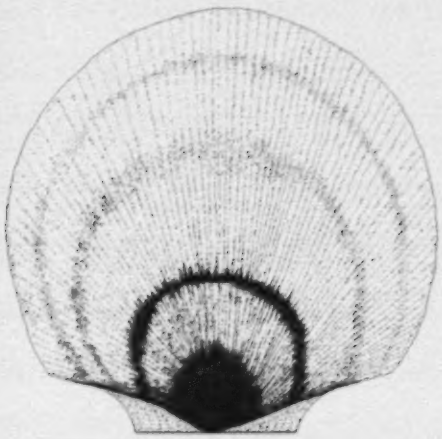
Maritimes Region

Canadian Science Advisory Secretariat
Science Advisory Report 2015/035

# ASSESSMENT OF SCALLOPS (*PLACOPECTEN MAGELLANICUS*) IN SCALLOP FISHING AREA (SFA) 29 WEST OF LONGITUDE 65°30'W



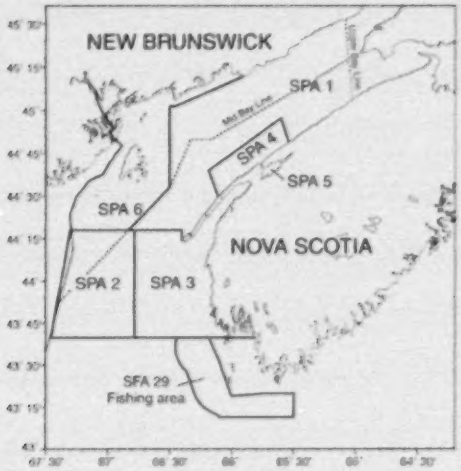



*Figure 1. Location of the portion of SFA 29 west of longitude 65°30'W. Refer to full detail map in Appendix 1 for place names.*

## Context:

*Scallop Fishing Area (SFA) 29 encompasses a very large inshore area inside the 12-mile territorial sea, from the south of Yarmouth (latitude 43°40'N) to Cape North in Cape Breton. This report refers to only that portion of SFA 29 west of longitude 65°30'W continuing north to Scallop Production Area (SPA) 3 at latitude 43°40'N (Figure 1), hereafter referred to as SFA 29 West.*

*Prior to 1986, the Full Bay Scallop Fleet fished in this area. Following the 1986 inshore/offshore scallop fishing agreement, fishing by the Full Bay Fleet was restricted to north of latitude 43°40'N. A limited fishery by the Full Bay Fleet was granted from 1996–98. Access was again granted to this fleet in 2001 with a full at-sea monitoring program and with a condition of a post-season industry-funded survey. SFA 29 West is within Lobster Fishing Area (LFA) 34 and, as a result, scallop fishers consulted with lobster fishers in the area to deal with potential conflicts. Lobster and bycatch of other species continue to be monitored in this fishery. In 2002, Fisheries and Oceans Canada (DFO) approved access to this area by the Full Bay Fleet and a number of inshore East of Baccaro licence holders who are eligible to fish in SFA 29 West. SFA 29 inshore scallop licences were historically restricted to East of Baccaro (east of longitude 65°30'W). A joint project agreement was signed with the fishing fleets, Natural Resources Canada, and DFO, with all parties providing funds to conduct multi-beam acoustic mapping of the seafloor and other scientific work. Using the multibeam data and associated derived layers a scallop habitat suitability map was developed and covers SFA 29 West subareas A–D. This map was used to develop the framework assessment methodology for SFA 29 West accepted in February 2014.*

*This Science Advisory Report is from the March 24, 2015, Assessment of SFA 29 West of 65°30' Scallop. Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.*

June 2015

Canada

## SUMMARY


- This scallop fishery has taken place in the portion of Scallop Fishing Area (SFA) 29 west of longitude 65°30' W since 2001 and is currently conducted by two fleets: the Full Bay Fleet and a number of inshore East of Baccaro licence holders who are eligible to fish in SFA 29 West.
- A new framework assessment methodology was accepted in February 2014 that uses a habitat-based population model for subareas A–D. The model is based on a scallop habitat map. This map does not cover subarea E.
- A science update was originally scheduled for SFA 29 West in 2015; however, due to observations from the science survey in 2014 that the extremely strong year class which prompted the closure of subareas C and D in 2014 was very much diminished, a full assessment was triggered.
- As of 2010, the Total Allowable Catch (TAC) and landings are reported as totals by subarea for both fleets combined. In 2014, subareas A, B, and E were open and a total of 128.4 t was landed against the TAC of 135 t. There was an additional Food, Social and Ceremonial catch of 5.3 t. Subareas C and D were closed to fishing in 2014 to protect high abundances of juvenile scallops.
- From the survey, in 2014, commercial densities were generally similar across habitat suitability categories within subareas and were low compared with earlier in the time series. The number of recruit size scallops was also relatively low across habitat categories across subareas.
- In 2013, pre-recruit abundance observed was the highest in the time series, and subareas C and D were closed to protect this strong year class. However, this year class was not observed in subareas A, B, and C during the 2014 survey despite additional tows repeating those conducted in 2013 in areas where high pre-recruit abundances were found. In subarea D, this strong year class had the highest survival across subareas and these animals are now approximately 50–80 mm. A new year class approximately 20–40 mm shell height was also observed in 2014 in subareas C and D. Overall pre-recruit abundance in subareas C and D is near the highest of the time series, whereas pre-recruit levels decreased to near the lowest of the time series in subareas A and B across habitat categories.
- In 2014, it was estimated that 9,304 lobsters were caught during the SFA 29 West scallop fishery, including 2,374 dead or injured. The estimated number of lobster caught represents < 0.02% of the lobsters caught in the 2013/2014 Lobster Fishing Area (LFA) 34 lobster fishery and < 0.1% of the lobsters caught in the area of LFA 34 corresponding to SFA 29 West.
- Catch scenario tables are presented for subareas A–D. For subarea A, biomass declines are predicted even if no catch is taken in 2015. For subareas B, C, and D, overall catches of up to 39 t, up to 27 t, and up to 51 t, respectively, have a ≥ 50% probability of biomass increases in the High habitat suitability categories; however, biomass densities across habitat categories in subareas B–D are currently near the lowest of the time series.
- For subarea E, catch rates remained relatively stable from 2013 to 2014 at approximately 23 kg $h^{-1}$; however, survey numbers per tow decreased for commercial and recruit size scallops and very few pre-recruit size scallops were observed.

## BACKGROUND

As part of the Regional Science Advisory Process, a meeting was held on March 24, 2015, at the Bedford Institute of Oceanography in Dartmouth, Nova Scotia to review the 2014 scallop fishery and assess the status of the scallop stock in Scallop Fishing Area (SFA) 29 West in support of the management of the 2015 fishery. Specifically, the meeting was called to provide science advice for the SFA 29 West scallop fishery by subarea based on the state-space habitat-based population model for subareas A–D and accepted at the framework meeting in February 2014. The model is based on a scallop habitat map. This map does not cover subarea E. A science update was originally scheduled for SFA 29 West in 2015; however, due to observations from the science survey in 2014 that the extremely strong year class which prompted the closure of subareas C and D in 2014 was very much diminished, a full assessment was triggered. An assessment of the lobster bycatch was also provided.

## ASSESSMENT

### Fishery

This scallop fishery has taken place in the portion of SFA 29 west of longitude 65°30'W since 2001. The Full Bay (FB) scallop fleet was the sole participant in 2001. Starting in 2002, the total allowable catch (TAC) was shared between the FB fleet and a number of inshore East of Baccaro (EoB) licence holders who were eligible to fish in SFA 29 West. As of 2010, the TAC and landings are reported as totals by subarea for both fleets combined. In 2014, a total of 128.4 t was landed against the TAC of 135 t. There was an additional Food, Social and Ceremonial (FSC) catch of 5.3 t (Table 1; Figure 2).

*Table 1. Scallop landings (meats, t) and TACs for subareas of SFA 29 West in 2014. Table includes FSC catch, which is added to the total landings but does not count against the TAC. The TAC is shared between subareas A and E. (Dash indicates no catch). Note subareas C and D were closed to fishing in 2014.*

| | | Fleets Combined | | First Nations | |
|---|---|---|---|---|---|
| | | TAC (t) | Landings (t) | FSC (t) | Total Landings (t) |
| 2014 | A | 45.0 | 3.0 | - | 3.0 |
| | E | | 27.3 | - | 27.3 |
| | B | 90.0 | 98.1 | 5.3 | 103.4 |
| | C | 0 | - | - | - |
| | D | 0 | - | - | - |
| | **Total** | **135.0** | **128.4** | **5.3** | **133.7** |

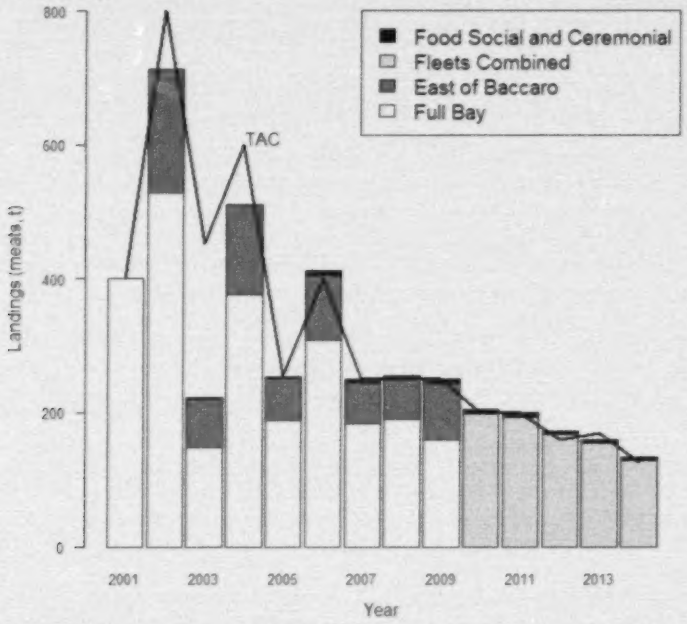



*Figure 2. Annual scallop landings (meats, t) from 2001 to 2014 by fleet, which count against the TAC; landings for FSC purposes, which do not count against the TAC; and total TAC for SFA 29 West.*

The scallop fishery in SFA 29 West in 2014 occurred in subareas A, B, and E (Appendix 1). Subareas C and D were closed to fishing in 2014 to protect high abundance of juvenile scallops. Subareas A and E opened for the 2014 fishing season on June 23rd. Subarea B opened on July 3rd. Subarea B was closed on August 8, 2014, and had an overrun of 8.1 t. Subareas A and E were closed on August 31, 2014. Lobster bycatch has not resulted in any closures since 2009.

## Survey

A post-season joint industry/departmental research survey has been conducted annually since 2001 when the current fishery started. The survey design was initially a simple random design over the whole area. From 2002 to 2004, a stratified random design was used with strata defined by the management subareas A to E. Starting in 2005, strata were defined by bottom type as identified by geologists as part of the joint industry/government multibeam mapping project conducted in this area. A new interpretation of the bottom types was made available in 2008 and was used to design the surveys for 2008 through 2013. In 2014, a new survey design based on the assessment approach in Smith et al. (2015) using scallop habitat suitability probabilities categories was used. The new assessment approach uses categories of scallop habitat suitability to define strata, with habitat suitability probabilities binned into 3 categories defined by Low [0, 0.3), Medium [0.3, 0.6), and High [0.6, 1.0). Survey estimates from 2001 to 2013 were modified to correspond to the new design. Subarea E has not been consistently covered in the survey due to time limitations; this subarea is considered to be marginal habitat for scallops and, as a result, has been less of a survey priority. However, survey tows in subarea E have been conducted since 2012 in response to increased fishing in this area.

Time trends in abundance (number per tow) of commercial (≥ 100 mm shell height), recruit size (90–99 mm), and pre-recruits (< 90 mm) scallops are plotted in Figures 3–5. In 2014, commercial densities were generally similar across habitat suitability categories within subareas and were low compared with earlier in the time series. In subarea A, the number of commercial animals decreased in the Low

category but remained similar to 2013 in the Medium category. In subarea B, commercial numbers decreased across habitat categories. In subarea C, there was no fishing in 2014 and commercial numbers remained relatively similar to 2013 across habitat categories. In subarea D, there was no fishing in 2014 and commercial numbers increased slightly in the High and Medium categories and did not change in the Low (Figure 3).

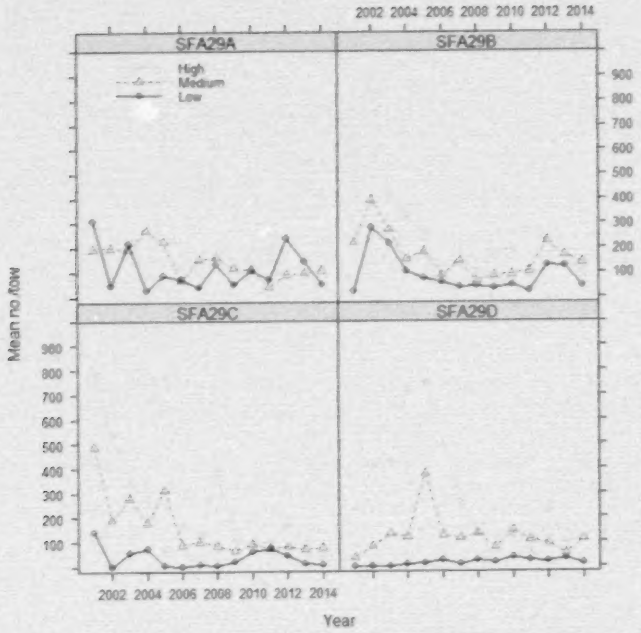



*Figure 3. Survey mean number per tow for commercial size scallops (≥ 100 mm) by subarea for SFA 29 West for Low, Medium and High categories of habitat suitability probabilities.*

The number of recruit size scallops in 2014 was relatively low across habitat categories across subareas and are near the lowest of the time series in all areas (Figure 4).

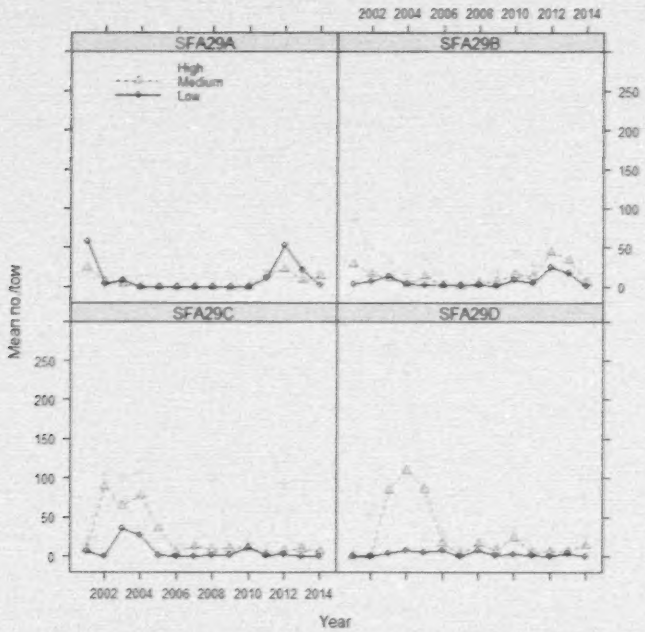



*Figure 4. Survey mean number per tow for recruit size scallops (90–99 mm) by subarea for SFA 29 West for Low, Medium and High categories of habitat suitability probabilities.*

In 2013, pre-recruit abundance observed was the highest in the time series, and subareas C and D were closed to protect this strong year class (Figure 5). However, this year class was not observed in subareas A, B, and C during the 2014 survey despite additional tows repeating those conducted in 2013 in areas where high pre-recruit abundances were found. From the 2014 survey, including the extensive review of repeated tows, it can be concluded that the decline in pre-recruits abundance is not due to the survey design and is possibly due to high mortality on this year class with the exception of some areas in subarea D. Since there was no fishing in subareas C and D in 2014 incidental fishing mortality was not a factor in the decline observed in these respective areas. In subarea D, this strong year class had the highest survival across subareas and these animals are now approximately 50–80 mm. A new year class approximately 20–40 mm shell height was also observed in 2014 in subareas C and D. It is this new year class that is mainly responsible for the relatively high pre-recruit abundance per tow in subarea C (Figure 5). Overall pre-recruit abundance in subareas C and D is near the highest of the time series, whereas pre-recruit levels decreased to near the lowest of the time series in subareas A and B across habitat categories.

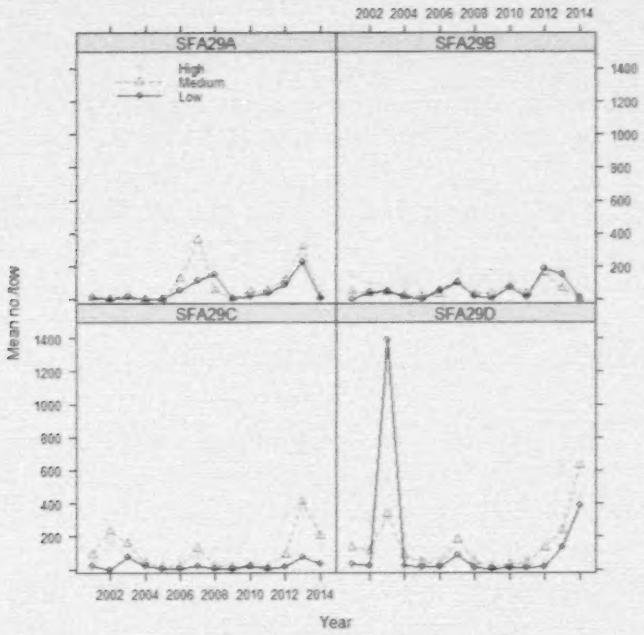



*Figure 5. Survey mean number per tow for pre-recruit size scallops (< 90 mm) by subarea for SFA 29 West for Low, Medium and High categories of habitat suitability probabilities.*

## Assessment

A new framework assessment methodology was accepted in February 2014 that uses a habitat-based population model for subareas A–D. The state-space habitat-based population model was fit to the commercial catch, effort derived from vessel monitoring system data, and survey data.

The population biomass density was much higher in the High suitability category at the beginning of the fishery and has been reduced over time to be more similar to densities found in the Medium and Low suitability categories. Commercial densities are currently near the lowest of the time series. The modelled recruit density estimates (numbers per $km^2$) indicate that recruit densities are low across all subareas A–D and numbers are similar across habitat categories, with a slight increase observed in subarea D. These trends are consistent with what was observed in the survey. Exploitation trends by habitat suitability showed higher exploitation rates in the High suitability categories for subareas B–D and in the Medium category for subarea A.

Subarea E is not covered by the scallop habitat suitability map; therefore, the model cannot be used for this area. In 2014, fishing in subarea E occurred along the border with subarea B, similar to previous years and catch rates remained similar to 2013 at approximately 23 kg $h^{-1}$. Much of Subarea E is considered to be marginal habitat for scallops and was not routinely covered by the survey until 2012. Coverage in 2012 and 2013 consisted of exploratory stations with tows chosen in locations where fishing had occurred in the associated year. In 2014, regular random survey tows were conducted; however, these were limited to areas fished since 2002. Given the above caveats, and although trends in survey abundance in subarea E are not indicative of trends in the subarea as a whole, commercial numbers in 2014 were 93 per tow compared to 146 per tow in 2013 and recruit numbers in 2014 were 5 per tow compared to 11 per tow in 2013. There were very few pre-recruits observed in subarea E during the 2014 survey.

## Lobster

In 2014, there were 507 observed tows (63 EoB and 444 FB), 30 days observed (4 EoB and 26 FB) and 7 trips observed (1 EoB and 6 FB). It was estimated that 9,304 lobsters were caught during the SFA 29 West scallop fishery in 2014. This relates to a weight of approximately 4.7 t using the average observed carapace length (86 mm) and average weight of a lobster (0.51 kg) caught in SFA 29 West in 2014. This is down significantly from 2013 (8.9 t) but still above the 2012 estimate (2.8 t). The estimated number of dead or injured lobsters was 2,374. The estimated number of lobster caught represents approximately 0.02% of the lobsters caught in the 2013/2014 Lobster Fishing Area (LFA) 34 lobster fishery and < 0.1% of the lobsters caught in the area of LFA 34 corresponding to SFA 29 West. Trends in lobster catches by the lobster fishery in the SFA 29 West area as a whole are not indicative of an area that has been adversely affected by the scallop fishery since 2001.

## Sources of Uncertainty

Advice on expected impacts of the 2015 fishery was based on current year (2014) estimates of condition and uses the mean of natural mortality estimates from the last six years (2009 to 2014) for each habitat type within subarea.

# CONCLUSIONS AND ADVICE

Biomass in the High category was used as an indicator of the overall stock status in subareas B, C, and D. Biomass in the Medium category was used as an indicator in subarea A, since the area of High category in subarea A is very small (< 1%). Catch, exploitation, percent change in commercial biomass, and the probability of biomass decline were determined from the model for a range of potential catches and are presented as catch scenario tables for subareas A–D in Tables 2–5. Note that for subarea A, biomass declines are predicted even if no catch is taken in 2015. Model estimates indicate that natural mortality has been increasing in subarea A since 2008. For subareas B, C, and D, overall catches of up to 39 t, up to 27 t, and up to 51 t, respectively, have a ≥ 50% probability of biomass increases in the High habitat suitability categories; however, biomass densities across habitat categories in subareas B–D are currently near the lowest of the time series.

For subarea E, catch rates remained relatively stable from 2013 to 2014 at approximately 23 kg $h^{-1}$; however, survey numbers per tow decreased for commercial and recruit size scallops and very few pre-recruit size scallops were observed.

*Table 2. Catch scenario table for SFA 29A to evaluate 2015 catch levels in terms of expected changes in biomass (%) and probability of decline.*

| Subarea Catch (t) | Exploitation in Medium Category | Expected change in biomass (%) in Medium Category | Prob. of Biomass Decline in Medium Category | Expected change in biomass (%) in Subarea | Prob. of Biomass Decline in Subarea |
|---|---|---|---|---|---|
| 0 | 0 | -15.8 | 0.6 | -4.8 | 0.54 |
| 3 | 0.02 | -19.7 | 0.63 | -7.4 | 0.56 |
| 6 | 0.04 | -19.9 | 0.63 | -8.5 | 0.57 |
| 10 | 0.06 | -21.9 | 0.64 | -10.3 | 0.58 |
| 13 | 0.08 | -24 | 0.66 | -11.8 | 0.6 |
| 16 | 0.1 | -24.2 | 0.65 | -12.2 | 0.6 |
| 19 | 0.13 | -27.1 | 0.68 | -14.5 | 0.62 |
| 22 | 0.14 | -27.5 | 0.67 | -15 | 0.62 |
| 25 | 0.17 | -29.8 | 0.69 | -17.1 | 0.65 |
| 29 | 0.19 | -30.9 | 0.7 | -18.7 | 0.66 |
| 32 | 0.21 | -32.5 | 0.71 | -20.9 | 0.67 |
| 35 | 0.22 | -33.4 | 0.72 | -21.8 | 0.68 |

*Table 3. Catch scenario for SFA 29B to evaluate 2015 catch levels in terms of expected changes in biomass (%) and probability of decline.*

| Subarea Catch (t) | Exploitation in High Category | Expected change in biomass (%) in High Category | Prob. of Biomass Decline in High Category | Expected change in biomass (%) in Subarea | Prob. of Biomass Decline in Subarea |
|---|---|---|---|---|---|
| 0 | 0 | 15.6 | 0.4 | 14.5 | 0.36 |
| 7 | 0.02 | 13.2 | 0.41 | 12.8 | 0.36 |
| 13 | 0.04 | 12.3 | 0.43 | 12.9 | 0.36 |
| 20 | 0.06 | 8.6 | 0.44 | 11.4 | 0.38 |
| 26 | 0.08 | 6.2 | 0.46 | 11.1 | 0.38 |
| 33 | 0.1 | 4.3 | 0.47 | 10.4 | 0.39 |
| 39 | 0.12 | 2.8 | 0.48 | 9.5 | 0.39 |
| 46 | 0.14 | -1.6 | 0.51 | 8.4 | 0.41 |
| 52 | 0.16 | -3.1 | 0.52 | 6.3 | 0.43 |
| 59 | 0.18 | -5.1 | 0.54 | 6 | 0.44 |
| 66 | 0.2 | -9.2 | 0.56 | 6 | 0.44 |
| 72 | 0.22 | -10.1 | 0.57 | 2.8 | 0.47 |

*Table 4. Catch scenario for SFA 29C to evaluate 2015 catch levels in terms of expected changes in biomass (%) and probability of decline.*

| Subarea Catch (t) | Exploitation in High Category | Expected change in biomass (%) in High Category | Probability of Biomass Decline in High Category | Expected change in biomass (%) in Subarea | Probability of Biomass Decline in Subarea |
|---|---|---|---|---|---|
| 0 | 0 | 15.4 | 0.44 | 21.4 | 0.31 |
| 4 | 0.02 | 13.9 | 0.43 | 18.8 | 0.32 |
| 8 | 0.04 | 11.3 | 0.45 | 17.9 | 0.34 |
| 12 | 0.06 | 11 | 0.45 | 15.7 | 0.35 |
| 15 | 0.08 | 8.5 | 0.46 | 13.6 | 0.36 |
| 19 | 0.1 | 6.7 | 0.47 | 13.3 | 0.37 |
| 23 | 0.12 | 3.7 | 0.49 | 13.2 | 0.38 |
| 27 | 0.14 | 0.6 | 0.5 | 10.1 | 0.4 |
| 31 | 0.16 | -1.5 | 0.51 | 8.8 | 0.42 |
| 35 | 0.18 | -3.6 | 0.52 | 8.5 | 0.42 |
| 38 | 0.2 | -7.1 | 0.53 | 5.7 | 0.44 |
| 42 | 0.22 | -12.3 | 0.56 | 3.4 | 0.47 |

*Table 5. Catch scenario for SFA 29D to evaluate 2015 catch levels in terms of expected changes in biomass (%) and probability of decline.*

| Subarea Catch (t) | Exploitation in High Category | Expected change in biomass (%) in High Category | Probability of Biomass Decline in High Category | Expected change in biomass (%) in Subarea | Probability of Biomass Decline in Subarea |
|---|---|---|---|---|---|
| 0 | 0 | 28.7 | 0.29 | 19 | 0.26 |
| 5 | 0.02 | 24.3 | 0.3 | 17.3 | 0.28 |
| 10 | 0.04 | 21.1 | 0.32 | 15.9 | 0.29 |
| 15 | 0.06 | 18.9 | 0.35 | 13.3 | 0.32 |
| 20 | 0.08 | 17.9 | 0.35 | 13.3 | 0.33 |
| 25 | 0.1 | 15.6 | 0.37 | 11 | 0.35 |
| 31 | 0.12 | 10.6 | 0.4 | 9.3 | 0.36 |
| 36 | 0.14 | 9.9 | 0.41 | 7.4 | 0.4 |
| 41 | 0.16 | 7.2 | 0.43 | 6.4 | 0.41 |
| 46 | 0.18 | 3.8 | 0.47 | 5.1 | 0.43 |
| 51 | 0.2 | 2.1 | 0.47 | 3.1 | 0.46 |
| 56 | 0.22 | -0.9 | 0.51 | 1.1 | 0.48 |
| 61 | 0.24 | -3.5 | 0.54 | 0.4 | 0.49 |

## OTHER CONSIDERATIONS

Scallop removals accounted for in the assessment include landings from the inshore scallop fleets and FSC catch, when applicable. For non-scallop fisheries where bycatch information is available, scallop discards were insignificant compared to discards from the inshore scallop fleet (Gavaris et al. 2010).

Information on discards of other species from the 2014 SFA 29 West scallop fishery was presented at the meeting.

## SOURCES OF INFORMATION

This Science Advisory Report is from the March 24, 2015, Assessment of SFA 29 West of 65°30'W Scallop. Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.

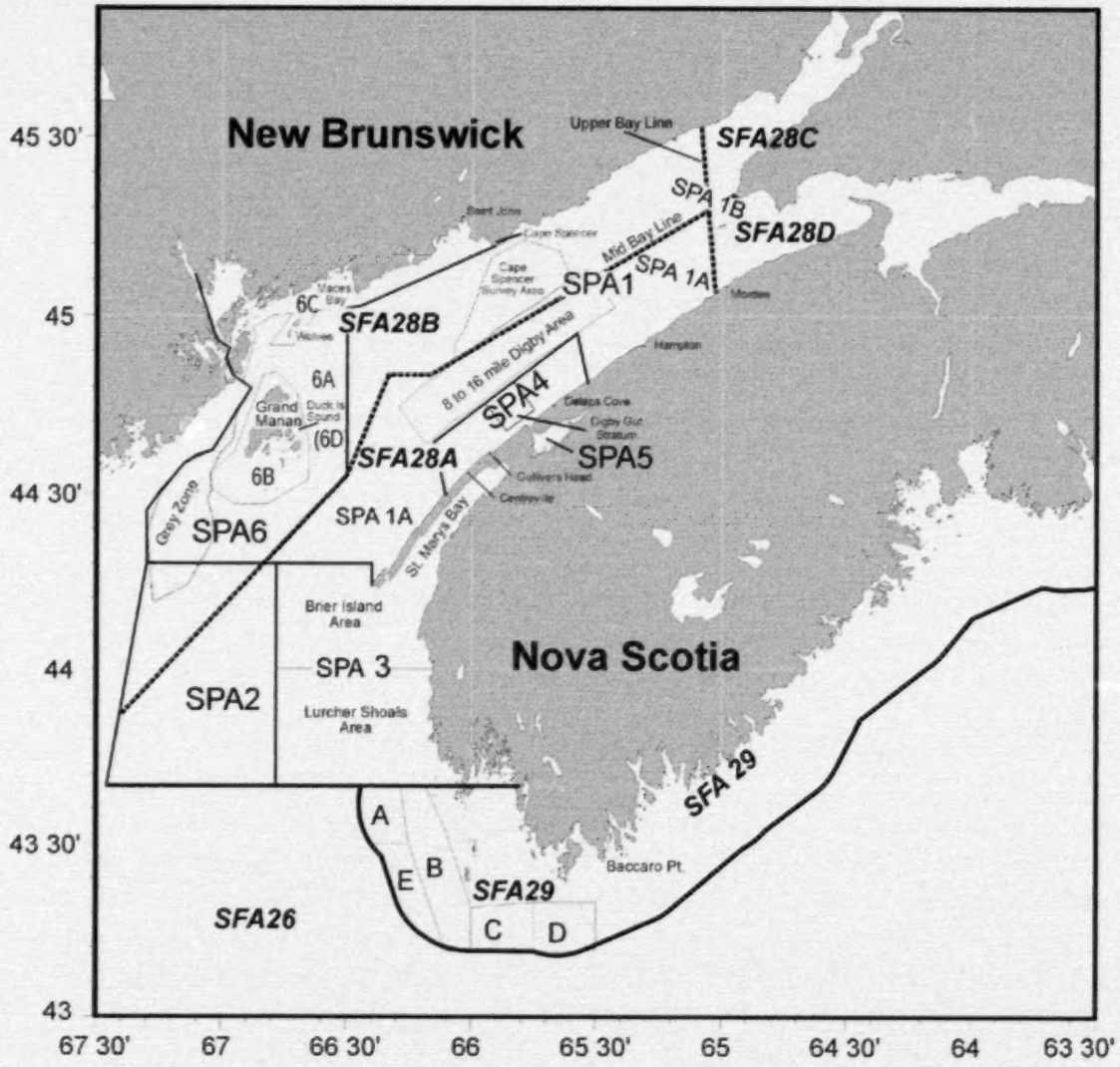
Gavaris, S., K. Clark, A. Hanke, C. Purchase, and J. Gale. 2010. Overview of Discards from Canadian Commercial Fisheries in NAFO Divisions 4V, 4W, 4X, 5Y and 5Z for 2002–2006. Can. Tech. Rep. Fish. Aquat. Sci., 2873: vi + 112 pp.

Sameoto, J.A., Smith, S.J., Glass, A., Hubley, B., Denton, C. 2014. Scallop Fishing Area 29: Stock status and update for 2014. DFO Can. Sci. Advis. Sec. Res. Doc. 2014/064. v + 66 p.

Smith, S. J., Nasmith, L., Glass, A. and Hubley, B. 2015. Framework assessment for SFA 29 West scallop fishery. DFO Can. Sci. Advis. Sec. Res. Doc. 2014/110. v + 71 p.

# APPENDIX

*Appendix 1. Locations and place names for inshore Scallop Fishing Areas (SFAs) and Scallop Production Areas (SPAs).*



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Centre for Science Advice (CSA)
Maritimes Region
Fisheries and Oceans Canada
Box 1006, Stn. B203
Dartmouth, Nova Scotia
Canada B2Y 4A2

Telephone: 902-426-7070
E-Mail : XMARMRAP@mar.dfo-mpo.gc.ca
Internet address: www.dfo-mpo.gc.ca/csas-sccs/

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*Aussi disponible en français :*

*MPO. 2015. Évaluation du stock de pétoncles (Placopecten magellanicus) de la zone de pêche du pétoncle (ZPP) 29 à l'ouest de la longitude 65°30' O. Secr. can. de consult. sci. du MPO, Avis sci. 2015/035.*